

# THE CACTACEAE OF THE NATURAL MUNICIPAL PARK OF PRAINHA, RIO DE JANEIRO, BRAZIL: TAXONOMY AND CONSERVATION<sup>1</sup>

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## ABSTRACT

This paper contains the floristic inventory for the Cactaceae occurring in the Natural Municipal Park of Prainha, located at 23° 02' 41"S 43° 30' 40"W, in the Rio de Janeiro Municipality, Rio de Janeiro State, Brazil. The area is a threatened native Atlantic Forest remnant with no floristic inventory. Ten Cactaceae genera occur in the Park, which are *Pereskia* Mill. (1 sp.), *Brasiliopuntia* (K. Schum.) A. Berger (1 sp.), *Opuntia* Mill. (1 sp.), *Epiphyllum* Haw. (1 sp.), *Hylocereus* (A. Berger) Britton & Rose (1 sp.), *Lepismium* Pfeiff. (1 sp.), *Rhipsalis* Gaertn. (5 spp.), *Cereus* Mill. (1 sp.), *Coleocephalocereus* Backeb. (1 sp.) and *Pilosocereus* Byles & Rowley (1 sp.). For the 14 taxa found in the survey we provide data on morphology, taxonomy, ecology and conservation that were obtained through field and literature research. Among the studied species, five are classified under threat categories and 54% are endemic to Brazil. A large floristic similarity was found between this Park and other coastal areas that have been surveyed in the Rio de Janeiro State.

KEY WORDS: Brazil, Cactaceae, Atlantic Forest, Conservation Units, Taxonomy

## RESUMEN

Este papel contiene el inventario florístico para las Cactaceae del Parque Natural Municipal de Prainha, situado en 23° 02' 41"S 43° 30' 40"W, en el municipio de Río de Janeiro, estado de Río de Janeiro, Brasil. El área es un amenazado remanente del Bosque Atlántico nativo, con la ausencia de inventarios florísticos. Diez géneros de Cactaceae ocurren en el Parque, los cuales, *Pereskia* Mill. (1 sp.), *Brasiliopuntia* (K. Schum.) A. Berger (1 sp.), *Opuntia* Mill. (1 sp.), *Epiphyllum* Haw. (1 sp.), *Hylocereus* (A. Berger) Britton & Rose (1 sp.), *Lepismium* Pfeiff. (1 sp.), *Rhipsalis* Gaertn. (5 spp.), *Cereus* Mill. (1 sp.), *Coleocephalocereus* Backeb. (1 sp.) e *Pilosocereus* Byles & Rowley (1 sp.). Para los 14 taxones encontrados en el examen proporcionamos datos en morfología, taxonomía, ecología y conservación, que fueron obtenidos a través de las actividades científicas a campo y del estudio de la literatura. Entre las especies estudiadas, cinco presentan algún grado de amenaza y 54% son endémicos al Brasil. Una semejanza florística grande fue encontrada entre este parque y otras áreas costeras que se han examinado ya en el estado de Río de Janeiro.

## INTRODUCTION

The Cactaceae family comprises about 100 genera and 1500 species distributed in four subfamilies: Opuntioideae, Pereskioideae, Maihuenioideae and Cactoideae (Hunt 1999). The species are restricted to the new world, with the exception of *Rhipsalis baccifera* (Mill.) Stearn, and can be recognized for the presence of the areole with spines and trichomes, succulent photosynthetic stems, absence of conspicuous leafs and flowers with receptacular epigyny (Barthlott & Hunt 1993). Cacti have a great economic importance and are widely spread as ornamental plants, but they also have many other uses as for medicine, as food, as cattle fodder, as fences, as fiber and filling, as furniture and as building material (Anderson 2001).

In Brazil occur 30% of the Cactaceae genera distributed in three of the four Cactaceae subfamilies: Opuntioideae, Pereskioideae and Cactoideae (Taylor & Zappi 2004). The species inhabit various vegetation formations as the *Cerrado* (Savanna), the *Caatinga* (Savannic Steppe) and the Atlantic Rain Forest, the latter being the main vegetation at the Natural Municipal Park of Prainha (Joly et al. 1999).

The Atlantic Forest has an estimated floristic diversity of 20000 species, and 6000 of them are endemic,

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<sup>1</sup>This work is part of the MSc. dissertation developed at the Programa de Pós-graduação em Ciências Biológicas (Botânica) of the Museu Nacional/ Universidade Federal do Rio de Janeiro.



however, this vegetation today is restricted to only 6% of the originally occupied area (Mittermeier et al. 2000). At the Rio de Janeiro State the original Atlantic Forest formations have been devastated by an intense human interference, especially by the coast, where are located the most populated areas in Brazil.

This study provides the floristic inventory for the Cactaceae at the Natural Municipal Park of Prainha (NMPP), an Atlantic Forest remnant located at the Rio de Janeiro city coast. Morphologic, taxonomic and ecological data on species and information that can be used to help the conservation of the NMPP and of the species are provided.

#### STUDY AREA

The Area named Prainha integrated the rural properties known as Camorim, Vargem Pequena e Vargem Grande Farms. In 1990 the Area of Environmental Protection (APA) of Prainha was created to save the natural scenario and to implement an ecological park at the region with the objectives of promoting the sustainable use through ecological tourism and recreation associated to environmental education activities. The Natural Municipal Park of Prainha (NMPP), originally named Ecological Municipal Park of Prainha was created in 1999 and today is under guard of the Municipal Secretariat of Environment—SMAC (Rio de Janeiro 1999). The park is located at S 23° 02' 41"W 43° 30' 40", at the Rio de Janeiro City, Brazil, between the Recreio dos Bandeirantes district and the APA of Grumari, and has 126.30 hectares (Fig. 1). In the park, a short extension beach is delimited by the coastal sides of the Caeté and Boa Vista hills and the Pedra dos Cabritos rock, building a natural amphitheater with the hillside varying from 0 to 460 m of altitude (Fig. 2). The part of the park located above 100 ms.m. is also included inside the area of the Pedra Branca State Park (Prefeitura da Cidade do Rio de Janeiro 1998).

The region is occupied by the Brazilian Atlantic Rain Forest (i.e. Dense Ombrophylous Atlantic Forest) in the hillsides and for the *restinga* vegetation (sandy coastal plane with pioneer communities) in areas near the beach (Ministério das Minas e Energia 1983; Joly et al. 1999). The existing forest at the area of study is mainly secondary in advanced process of natural regeneration with some scattered small more preserved areas of putative primary origin.

The steep hillsides and the hilltops are frequently dominated by gneiss-granite rock outcrops and those are colonized by a diverse rupicolous flora composed mostly from Cactaceae, Bromeliaceae and Velloziaceae taxa. The rock outcrop referred on the bibliography (Prefeitura da Cidade do Rio de Janeiro 1998) and also in this study as *Pedra dos Cabritos* (Cabritos Rock) is popularly named *Morro da Boa Vista* (Boa Vista Hill) and is the most visited site inside the park (Fig. 2).

#### METHODS

Botanical material was collected during 17 field excursions to 18 localities at the NMPP from April of 2003 to October of 2004 (Fig. 2). The specimens collected were prepared according with the usual herbarium techniques (Fidalgo & Bononi 1984) and incorporated in the Santa Úrsula University Herbarium (RUSU) and in the National Museum Herbarium (R). The following herbaria collections of the Rio de Janeiro State were consulted to obtain data: FCAB, GUA, HB, R, RB, RBR, RFA e RUSU (Holmgren et al. 1990). The basionyms were cited when applied and the synonyms were only cited when published recently (after 2000) or when they are names still being used erroneously in herbaria collections.

The conservation statuses for the Rio de Janeiro State species were obtained in Calvente et al. (2005). The categories were accessed according with the IUCN 3.1 version (2001). The floristic similarity between the NMPP and the other areas in the Rio de Janeiro State was analyzed with the software BioDiversity Pro Version 2/1997 (The Natural History Museum & Scottish Association for Marine Science) that was used for the production of a presence and absence matrix, the calculation of the Jaccard distance equation and for the creation of a dendrogram using the Group Average.



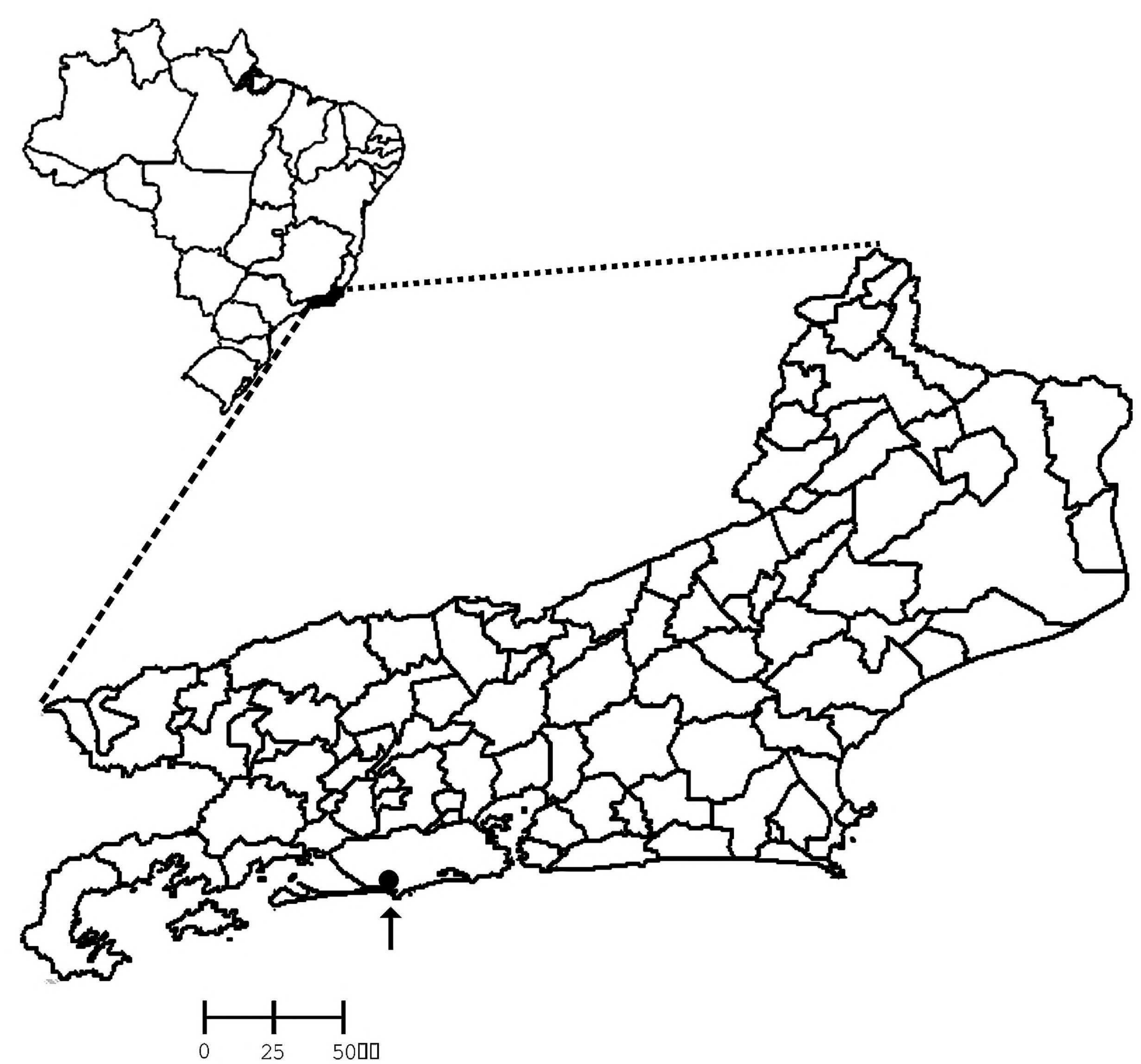


FIG. 1. Location of the Natural Municipal Park of Prainha, RJ (IPP, 1999a).

KEY TO CACTACEAE TAXA IN THE NATURAL MUNICIPAL PARK OF PRAINHA

- 1. Branches with well-developed leafs; pedunculated flowers. (Pereskioideae) \_\_\_\_\_ **1. Pereskia aculeata**
- 1. Branches leafless or with minute scale-like, persistent or deciduous leafs; sessile flowers.
  - 2. Glochids present. (Opuntioideae - Opuntieae)
    - 3. Tree with dimorphic stems, primary segments cylindrical and secondary segments flattened; perigonium segments all yellow; fruit globose \_\_\_\_\_ **2. Brasiliopuntia brasiliensis**
    - 3. Shrub with monomorphic stems, primary and secondary segments flattened; perigonium segments externally deep red and internally yellow; fruit turbinate \_\_\_\_\_ **3. Opuntia monacantha**
  - 2. Glochids absent. (Cactoideae)
    - 4. Columnar tree or shrub with 4–15 ribs. (Cereeae)
      - 5. Stem segments with 9–15 ribs; fruit dehiscent by a basal pore \_\_\_\_\_ **13. Coleocephalocereus fluminensis** subsp. **fluminensis**
      - 5. Stem segments with 4–6 ribs; fruit dehiscent by a longitudinal or lateral slit.
        - 6. Flowers 17–23 cm long; fruit dehiscent by a longitudinal slit \_\_\_\_\_ **12. Cereus fernambucensis** subsp. **fernambucensis**
        - 6. Flowers 6–9 cm long; fruit dehiscent by a lateral slit \_\_\_\_\_ **14. Pilosocereus arrabidaei**



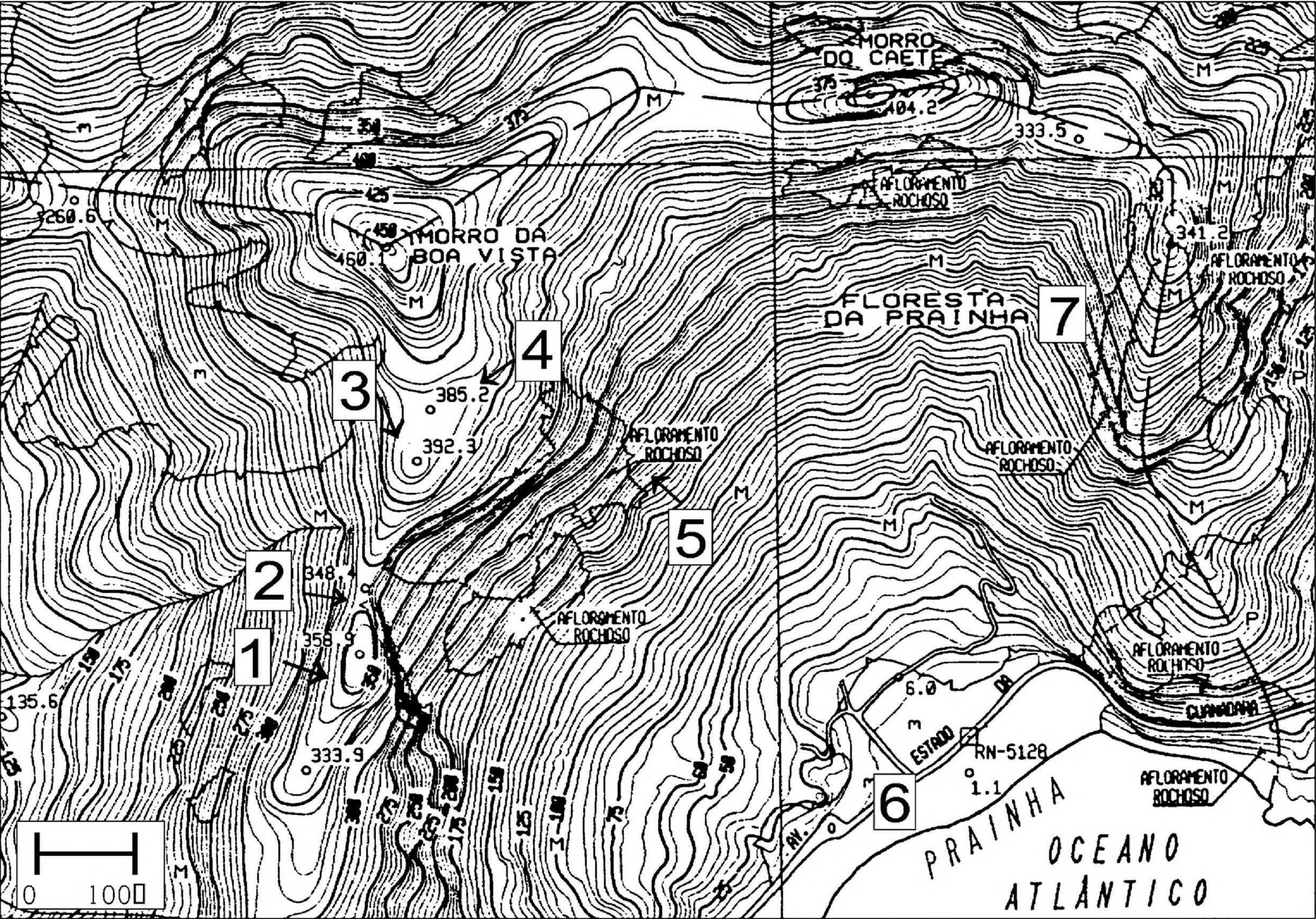


FIG. 2. Areas visited at the Natural Municipal Park of Prainha, RJ. 1. Pedra dos Cabritos; 2. Bosque das Mirtáceas; 3. Cruzeiro do Sul; 4. Bosque das Brasi-liopuntias; 5. Afloramento central; 6. Restinga; 7. Afloramento Leste. (IPP, 1999b).

- 4. Non-columnar epiphyte or scandent plants with stems cylindrical, flattened or with 3–5 wings.
- 7. Flower-tube 10–20 cm long, pericarpel and flower-tube with bract-scales. (Hylocereeae)
- 8. Stem segments 3-winged, areoles with 3–4 conical spines; flowers infundibuliform, 25–35 cm long  
\_\_\_\_\_ **5. Hylocereus setaceus**
- 8. Stem segments flattened, areoles glabrous; flowers hypocrateriform, 19–24 cm long  
\_\_\_\_\_ **4. Epiphyllum phyllanthus** subsp. **phyllanthus**
- 7. Flower-tube less than 0.5 cm or absent, pericarpel and flower-tube glabrous. (Rhipsalideae)
- 9. Stem segments flattened or 3–5 winged.
- 10. Branching mesotonic; segment areoles with copious pilose hairs \_\_\_\_\_ **6. Lepismium cruciforme**
- 10. Branching acrotonic or subacrotonic; segment areoles glabrous or with scarce pilose hairs, tomentose hairs or bract scales.
- 11. Wings discontinuous in the same stem segment \_\_\_\_\_ **9. Rhipsalis paradoxa** subsp. **paradoxa**
- 11. Wings continuous in the same stem segment.
- 12. Stem segments flattened, rarely 3-winged; perigonium segments golden yellow, fruit oblong purple \_\_\_\_\_ **7. Rhipsalis elliptica**
- 12. Stem segments 3–5-winged; perigonium segments white; fruit depressed-globose white or pinkish \_\_\_\_\_ **11. Rhipsalis triangularis**
- 9. Stem segments cylindrical.
- 13. Stem segments all of determinate growth; flowers 2.5–3 cm diam. \_\_\_\_\_ **8. Rhipsalis grandiflora**
- 13. Primary stem segments of indeterminate growth and secondary segments of determinate growth; flowers 0.9–1 cm diam. \_\_\_\_\_ **10. Rhipsalis teres** f. **heteroclada**

**1. Pereskia aculeata** Mill., Gard. dict. ed. 8. 1768. (Fig. 3 A–C).

**Shrub**, scandent, terricolous or rupicolous, glochids absent. **Stem** brown or purplish, woody, cylindrical, ca. 0.5 cm diam. **Leafs** alternate, elliptic, rarely obelliptic, 6–9 × 2.5–3 cm, slightly bicolor, purplish



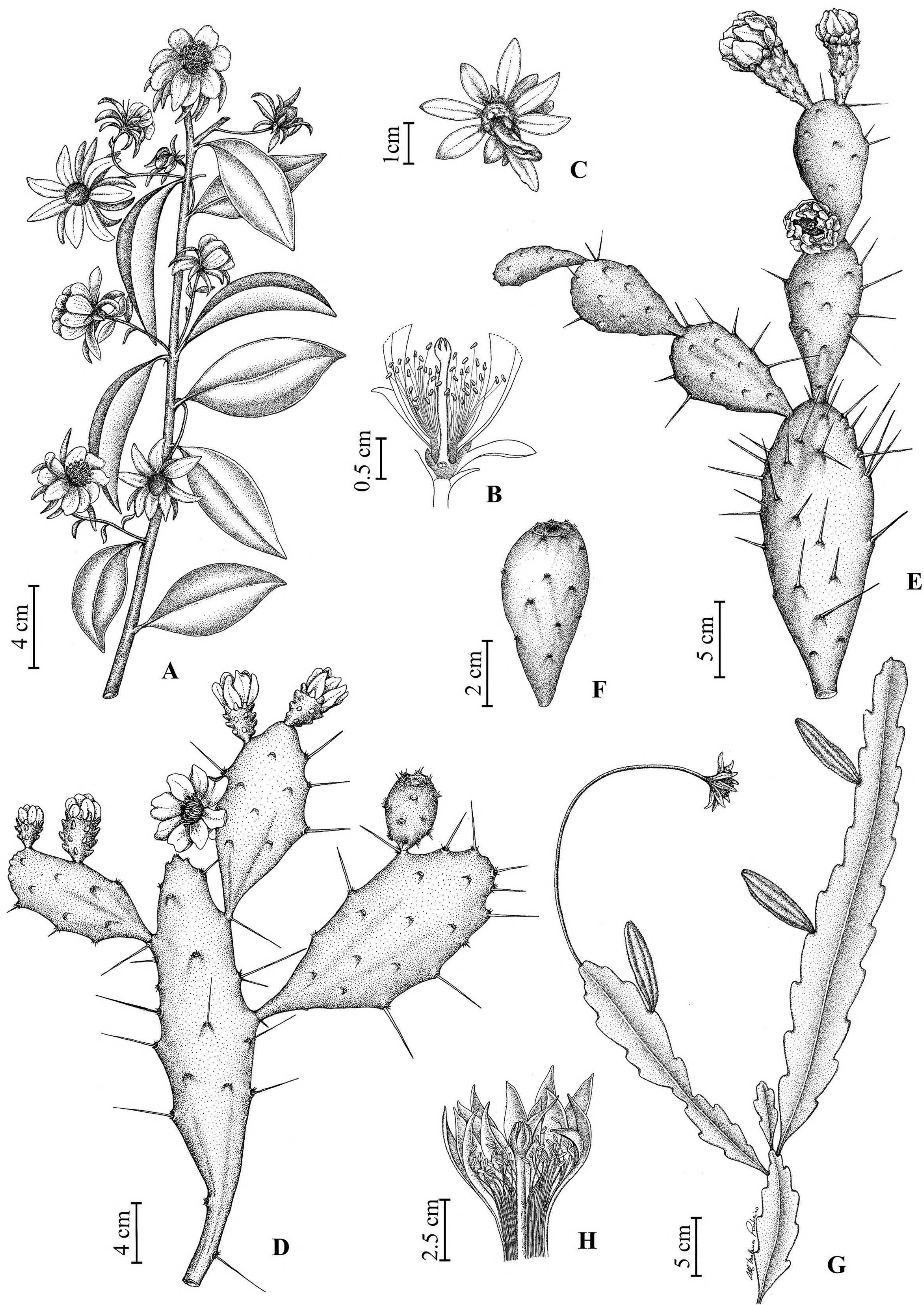


FIG. 3. A–C. *Pereskia aculeata* Mill. A. Branch with flowers, B. Longitudinal section of flower, C. Fruit. D. *Brasiliopuntia brasiliensis* (Willd.) A. Berger, flattened branch with flowers and fruits. E–F. *Opuntia monacantha* Haw.; E. Branch with flowers, F. Fruit. G–H. *Epiphyllum phyllanthus* (L.)Haw. subsp. *phyllanthus*; G. Branch with flower and immature fruits, H. Longitudinal section of flower.



green, venation inconspicuous. Areoles in the axils of leaves; spines 2, geminate, deltoid, retrorse, curve, ca. 2 cm long, sometimes absent. **Flower** diurnal, solitary or in inflorescences formed by the growing of one flower at the previous flower pedicel, rotate,  $4\text{--}6 \times 4$  cm; pedicel 2–5.5 cm long; pericarpel ca.  $0.5 \times 0.5$  cm. Pericarpel and pedicel areoles with 1 fleshy lanceolate basal bract-scale; hairs tomentose; spines 2–3 fine, acicular, 0.5–1.0 cm long, stiff. Perigonium external segments 5, deltoid, ca.  $0.2 \times 0.2$  cm, fleshy, green, apex acuminate; internal segments 13, obdeltoid to oblong, ca.  $1.5 \times 0.8\text{--}1.0$  cm, membranaceous, white or greenish, apex mucronate or emarginate; filament white, anther golden yellow; ovary semi-inferior, stigma with 3–5 lobes; nectary a ring around the style base. **Fruit** globose, ca.  $1.0 \times 0.8$  cm, orange, indehiscent, with persistent perigonium; fruit areoles with 1 fleshy lanceolate basal bract-scale (deciduous when ripe), tomentose hairs, (1–)2–3 acicular spines.

Heliophyte species commonly inhabiting the rock outcrops at the NMPP. The stigma frequently can be anomalous, exhibiting the fusion of two lobes or the short development of one lobe that becomes black and wilted. Flowers annually from February to April and fruits from April to August. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha,  $23^\circ 05'S$   $43^\circ 29'W$ , elev. 5 ms.m., 20 Jul 1995, *Scheinvar* 6272 (RB); Pedra dos Cabritos (topo do morro da Boa Vista), ca. 359 ms.m., 10 Apr 1996, *Braga & Bovini* 3320 (RUSU, RB); ibidem, 12 Apr 2003, *Calvente et al.* 34 (RUSU); ibidem, 29 Jan 2004, (25 Mar 2004, fl. cult.), *Calvente & Versieux* 85 (RUSU).

**2. *Brasiliopuntia brasiliensis*** (Willd.) A. Berger, *Entwicklungslin. Kakt.* 94. 1926. (**Fig. 3 D**). *Cactus brasiliensis* Willd., *Enum. pl. suppl.* 33. 1814. *Opuntia brasiliensis* (Willd.) Haw., *Suppl. pl. succ.* 79. 1819.

**Tree**, 3–6 m, terri-colous or rupicolous. **Trunk** woody, fleshy at apex. Areoles borne around the trunk; spines 6–25, acicular, 1.5–4.0 cm long. **Stem** segments dimorphic; primary segments cylindrical,  $22\text{--}40 \times 0.8\text{--}2.5$  cm, fleshy, green; secondary segments flattened, elliptic to oblong,  $6\text{--}15(\text{--}18) \times 3\text{--}5(\text{--}5.5)$  cm, fleshy, bicolor, green, sometimes yellowish. Stem segments areoles with short tomentose hairs; glochids numerous, deciduous; spines 0–1(–2), acicular, 1–3 cm long. Young stem segments areoles with 1 minute deltoid deciduous fleshy bract-scale; spines 1–2, acicular, 0.1–0.5 cm long. **Flower** diurnal, 0–1 per areole, sessile, rotate,  $2.5\text{--}3.5 \times 2.5\text{--}4.5$  cm; pericarpel depressed-obovate,  $1.2\text{--}1.6 \times 0.7\text{--}1.4$  cm, with areoles similar to the stem segments areoles but with 1 fleshy minute deltoid basal bract-scale; perigonium segments 15–17, obelliptic,  $1.0\text{--}1.6 \times 0.5\text{--}0.7$  cm, spreading, yellow; ovary inferior, stigma with 4–5 lobes. **Fruit** globose, ca. 3.5 cm diam., greenish yellow, indehiscent; fruit areoles with copious short tomentose hairs, numerous glochids; seed 2, 1 cm long, with copious, long, lanate hairs.

At the NMPP this species is sciophyte inside the forested areas where it can reach greater heights but it is shorter while growing as heliophyte on forest gaps. Many individuals are found growing close together, if one falls horizontally usually it will produce new shoots that grow vertically. Anomalous styles were frequently observed presenting a protuberance close to their apex, probably caused by the fusion of stamens parts or the fusion of the anther with style regions during the floral development. The flowers are visited by bees which are supposed to be the pollinators and by hemipterans which possibly feed perforating the stems. *Brasiliopuntia* was previously considered a synonym of *Opuntia* but today it is considered a separate genus based on molecular evidences (Wallace & Dickie 2002) and morphological apomorphies such as the heteromorphic stems (Taylor et al. 2002) and pollen grains with distinct ornamentation (Leuenberger 1976). Flowers annually during October, and usually the flowering is abundant and synchronic among the specimens. Immature fruits were observed from April to October. The fruits last many months to mature and were found semimature fallen to the ground during the following year flowering season. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Morro da Boa Vista, 30 Sep 1996, *Braga & Bovini* 3519 (RUSU); Bosque das Mirtáceas, 12 Apr 2003, *Calvente et al.* 33 (RUSU); Bosque das Brasiliopuntias, 17 Oct 2003, *Calvente et al.* 62 (RUSU); ibidem, 28 Oct 2003, *Calvente & Bocayuva* 65 (RUSU); ibidem, 10 Oct 2004, *Calvente & Versieux* 109, 110, 111 (RUSU).



### 3. *Opuntia monacantha* Haw., Suppl. pl. succ. 81. 1819. (**Fig. 3 E–F**).

**Shrub** non columnar, erect, 1–3 m, terri-colous. **Trunk** woody formed by the secondary growth of the basal stem segments. Areoles borne around the trunk; spines 3–12 acicular, ca 4 cm long, stiff. **Stem** segments monomorphic, flattened, obovate to elliptic, (7–)15–46 × (3.5–)8–15 cm, fleshy, green. Stem segments areoles with 1 minute deciduous fleshy basal bract-scale; hairs tomentose, short; glochids numerous; spines 1–2 acicular, 2–4(–5.5) cm long, stiff. **Flower** diurnal, 0–2(–3) per areole, sessile, rotate, 6–8 × 5–6 cm, many grouped in poorly defined floriferous regions; pericarpel turbinate, 4.0–6.0 × 2.0–2.5 cm, with areoles similar to the stem segments areoles but with only 1 acicular, ca. 0.7 cm long spine; perigonium segments ca. 29, deltoid to obovate, 1.5–3.0 × 1.0–1.5 cm, spreading, apex mucronate; external segments fleshy, purplish; internal segments membranaceous, yellow; stamens sensitive; ovary inferior, stigma with 6–7 lobes. **Fruit** turbinate, ca. 7 × 4 cm, reddish green, indehiscent; fruit areoles with short tomentose hairs, numerous deciduous glochids.

This is a frequent heliophyte species on the open *restinga* vegetation near the beach. The population occurring at the NMPP is not of great size and the number of young specimens around well established mature individuals suggests that this population is on a recovering stage and that this species may have a great clonal reproduction capacity. The flowers are visited by bees which are supposed to be the pollinators, by hemipterans and are predated by coleopterans that feed on the stamens after the anthesis. *Opuntia monacantha* was found sometimes erroneously misidentified as *O. vulgaris* Mill. on herbaria collections. This name is considered today a synonym of *O. ficus-indica* (L.) Mill. (Taylor et al. 2002). Flowering is annual, abundant and synchronic among individuals at the NMPP during February and from May to October. Immature fruits occur during almost the whole year and were found ripe in January. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, 27 Feb 1987, Giordano & Ferreira 230 (RB); vegetação de restinga próxima à praia, 06 Jun 2003, Calvente et al. 43 (RUSU); ibidem, 28 Oct 2003, Calvente & Bo-cayuva 69 (RUSU); ibidem 15 May 2004, Calvente & Versieux 92 (RUSU); Sede do Parque, próximo aos sanitários, 10 Oct 2004, Calvente & Versieux 101 (RUSU).

### 4. *Epiphyllum phyllanthus* (L.) Haw. subsp. **phyllanthus**, Syn. pl. succ. 197. 1812. (**Fig. 3 G–H**). *Cactus phyllanthus* L., Sp. pl. 1:469. 1753.

**Epiphyte**, glochids absent, branches ca. 1.5 m long, erect or with pendent apex. **Stem** segments flattened, somewhat oblong with lateral strangulations, 20–60 × 0.5–5 cm, leafless, fleshy, green, margin serrate or crenate. Areoles borne at the stem segments margins indents, glabrous. **Flower** nocturnal, 0–1 per areole, sessile, hypocrateriform, 19–24 × 3–4 cm; pericarpel oblong, ca 2.0 × 0.7 cm, with few sparse deltoid bract-scales; flower-tube long, 16–20 × 0.4 cm, with few sparse bract-scales; perigonium segments oblong, 1.0–1.2 × 0.3–0.4 cm, spreading, apex acute; external segments ca. 6, green; internal segments ca. 16, pinkish white; filament white, anther brown; ovary inferior, stigma with 9 lobes; nectar-chamber along the interior of the flower-tube. **Fruit** oblong, ca. 8.5 × 3 cm, green when immature, with few sparse oblong bract-scales.

This species can be semiheliophyte to sciophyte. It is probably pollinated by moths because of the long and slender flower-tube. According with Bauer (2003) the fruit when ripe is magenta and dehiscent by a lateral slit. It is a plant very frequent in its area of occurrence, inhabiting tropical forests and dryer forests such the ones in the northeast and middle west of Brazil. It flowers during October also when immature fruits were found. Kimnach (1964) distinguishes six varieties for this species (var. *phyllanthus*, *rubrocoronatum*, *hookeri*, *guatemalense*, *pittieri*, and *columbiense*), however, Bauer (2003) recognizes for *Epiphyllum phyllanthus* only the typical subspecies and the *E. phyllanthus* subspecies *rubrocoronatum* (Kimmach) Ralf Bauer, which are differentiated principally by the color of stamens, white on the former and red or orange to purple on the latter. The remaining varieties of Kimnach (1964) are considered subspecies of *E. hookeri* Haw. on Bauer's synopsis (2003), due to morphological and geographical aspects. **Conservation status:** Least Concern (LC).



Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, subida para o Morro da Boa Vista, ca. 200 ms.m., 09 Oct 1996, *Braga & Lira Neto* 3559 (RB); Bosque das Brasiliopuntias, 28 Oct 2003, *Calvente & Bocayuva* 66 (RUSU).

**5. *Hylocereus setaceus*** (Salm-Dyck ex DC.) Ralf Bauer, *Cactaceae Syst. Init.* 17:29. 2003. (**Fig. 4 A–B**).

*Cereus setaceus* Salm-Dyck ex DC., *Prodr.* 3:469. 1828. *Selenicereus setaceus* (Salm-Dyck ex DC.) Werderm., *Bras. Säulenkakt.* 87. 1933. *Selenicereus rizzinii* Scheinvar, *Rev. Brasil. Biol.* 34:249. 1974.

**Shrub**, scandent or prostrated, rupicolous, glochids absent. **Stem** segments 3-winged, (20–)35–120 × (2–)3–5 cm, leafless, fleshy, sometimes with woody parts, green, margin entire, lobed or faintly serrate. Areoles borne at the wings margins indents with short tomentose hairs; spines 3–4, lateral, conic, short, 0.4–0.5 cm long, stiff, pungent. **Flower** nocturnal, 0–1 per areole, sessile, infundibuliform, 25–35 × 6–8 cm, lateral; pericarpel ca. 4 × 2 cm. Pericarpel areoles borne on top of tubercles, with 1 oblong basal bract-scale with acute apex; hairs short, tomentose; spines 4–5, acicular, 6–8 cm long, slightly stiff, purplish. Flower-tube long, ca. 10 × 3 cm with areoles similar to the pericarpel areoles but gradually towards the flower apex with hairs and spines scarcer and longer bract-scales; perigonium segments ca. 40, erect to suberect, oblong; external segments 2–9 × 1 cm, fleshy, green, apex acute; internal segments ca. 9 × 2 cm, membranaceous, white, apex rounded; ovary inferior, stigma with 18 lobes; nectar-chamber along the interior of the flower-tube. **Fruit** ovoid, ca. 7.0 × 3.5 cm, purplish, indehiscent, perigonium black persistent. Fruit areoles with pilose hairs; spines 6–14, acicular, 0.5–0.8 cm long.

It is a heliophyte species very frequent on rock outcrops. Sometimes the stem segments have expanded conspicuous wings. It is probably pollinated by moths because of its long flower-tube. Recently, Bauer (2003) transferred this species from *Selenicereus* (L.) Britton & Rose to *Hylocereus* so it is common to find specimens at the herbaria still identified as *S. setaceus*. It flowers annually in October and fruits were observed from January to March. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Pedra dos Cabritos, 28 Oct 2003, *Calvente & Bocayuva* 68 (RUSU); Cruzeiro do Sul, 29 Jan 2004, *Calvente & Versieux* 80 (RUSU); ibidem, 10 Oct 2004, *Calvente & Versieux* 105, 106 (RUSU).

**6. *Lepismium* cruciforme** (Vell.) Miq., *Bull. Sci. Phys. Nat. Néerl.* 49. 1838. (**Fig. 5 A**). *Cactus cruciformis* Vell., *Fl. flum.* 207. 1829. icon. 5:tab.29. 1831. nom. cons.

**Epiphyte**, prostrated, mesotonically branched, glochids absent. **Stem** segments all of indeterminate growth 3-winged, 9–24 × 2–3 cm, leafless, fleshy, green, wings continuous in the same stem segment, margin crenate or serrate, extremes attenuate. Areoles borne at the wings margins indents, with copious long white pilose hairs. **Flower** diurnal, 0–2(–3) per areole, sessile, ca. 1 × 0.7 cm, lateral or subapical; pericarpel immerse in the areole, glabrous; flower-tube short, less than 0.5 cm, glabrous; perigonium segments 5–7, yellowish green to whitish, purple spotted; stamen pale yellow; ovary inferior, style purplish, stigma white with 3–4 lobes. **Fruit** globose, 0.5–0.6 cm diam, magenta, glabrous, indehiscent, perigonium deciduous.

Only one specimen was collected within the NMPP, growing as sciophyte without flowers, so its description here is based on additional specimens. Fruits were observed in October. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, 10 Oct 2004, *Calvente & Versieux* 108 (RUSU); Mun. Maricá, Restinga de Maricá, 24 Oct 1986, *Giordano et al.* 179 (RB). **São Paulo:** Mun. Londrina, entre a represa Chavantes e Jurumim, 20 Oct 1966, *Linderman & Haas* 3163 (RB).

**7. *Rhipsalis elliptica*** G. Lindb. ex K. Schum. in Martius, *Fl. Bras.* 4(2):293. 1890. (**Fig. 5 B–C**).

**Epiphyte**, branches ca. 60 cm long, acrotonically or rarely subacrotonically branched, glochids absent. **Stem** segments all of determinate growth, leafless, fleshy, green, margin crenate or incised; primary segments 1–3 subsequent, flattened, 9.5–23 × 0.4–2.0 cm, base semicylindrical; secondary segments 1–2(–3) in each branching axis, flattened, elliptic, oblong or obelliptic, rarely 3-winged, 4–16 × 1–5 cm, wings continuous at the same segment, margin sometimes undulate. Areoles borne at the wings margins indents, glabrous;



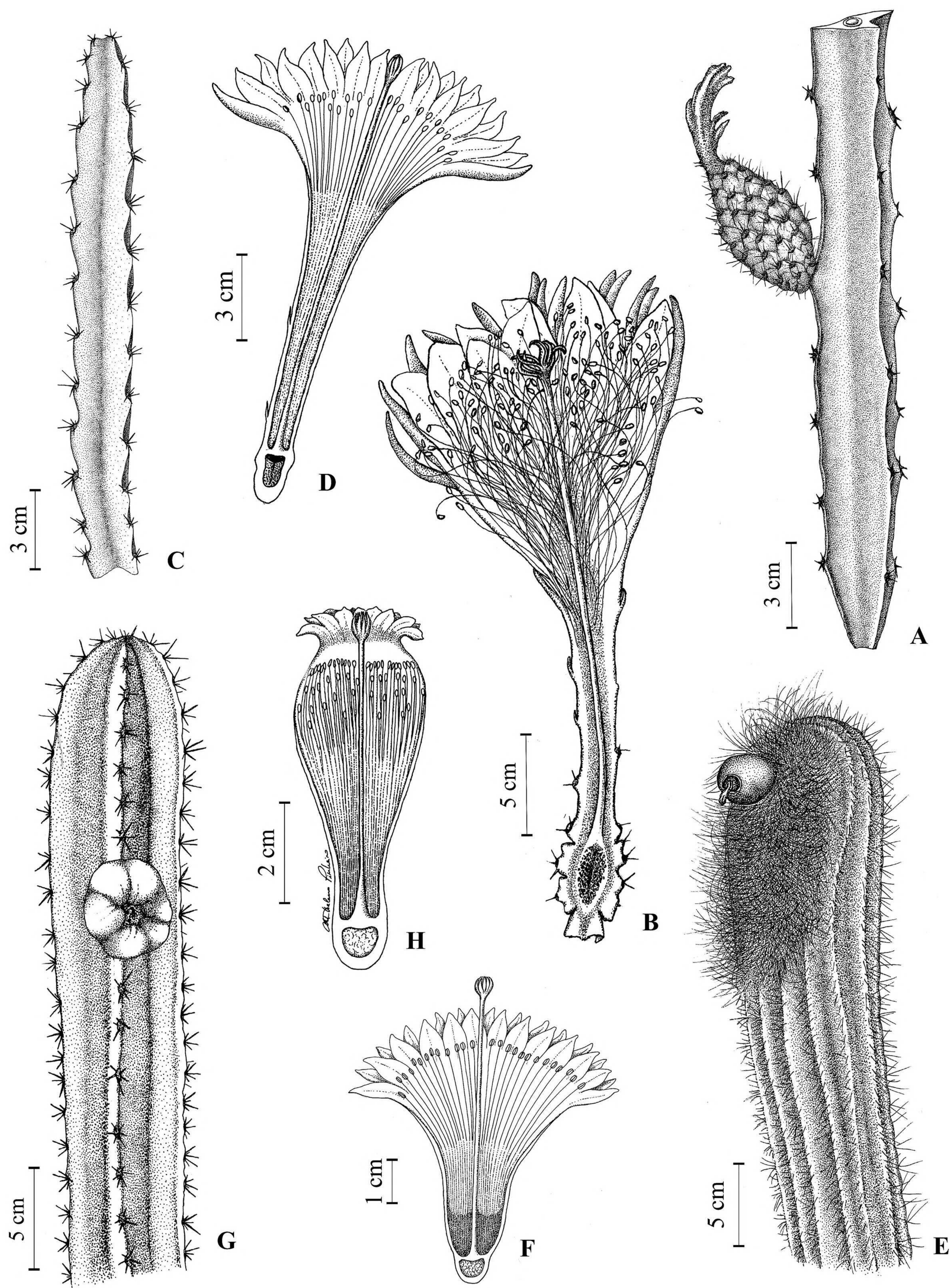


FIG. 4. A–B. *Hylocereus setaceus* (Salm-Dyck ex DC.) Ralf Bauer; A. Branch with immature fruit, B. Longitudinal section of flower. C–D. *Cereus fernambucensis* Lem. subsp. *fernambucensis*; C. Branch, D. Longitudinal section of flower. E–F. *Coleocephalocereus fluminensis* (Miq.) Backeb. subsp. *fluminensis*; E. Branch with fruit, F. Longitudinal section of flower. G–H. *Pilosocereus arrabidaei* (Lem.) Byles & Rowley; G. Branch with fruit, H. Longitudinal section of flower.



when on reproductive phase with scarce pilose hairs; 0–3(–5) bract-scales. **Flower** diurnal, 0–1(–2) per areole, sessile, rotate,  $1.0 \times 1.4$  cm, lateral or subapical, flower-tube absent; pericarpel  $0.5\text{--}0.6 \times 0.3\text{--}0.4$  cm, glabrous; perigonium segments golden yellow, membranaceous, conspicuously reflexed at anthesis involving the pericarpel; external segments 3, deltoid to oblong,  $0.05\text{--}0.4 \times 0.05\text{--}0.3$  cm; internal segments 5, oblong to obelliptic,  $0.6\text{--}0.7 \times 0.2\text{--}0.5$  cm; ovary inferior, stigma with 5 lobes; nectary a ring around the style base. **Fruit** oblong, ca.  $0.6 \times 0.4$  cm, purple, glabrous, indehiscent, perigonium deciduous.

This species is sciophyte and the margin of the stem segments can be lacerate by predation or wearing. Flowers annually and synchronically among the individuals in August. Fruits in November. The flowering period is short (ca. 1 week) and few fruits develop completely. It is endemic of the Brazilian Atlantic Forest.

**Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, trilha para a pedra dos cabritos (morro da Boa Vista), 09 Oct 1996, Braga 3554 (RUSU); ibidem, 22 Aug 2003, Calvente *et al.* 50 (RUSU); ibidem, 11 Jun 2004, Calvente & Versieux 96 (RUSU); trilha para o Cruzeiro do Sul, 22 Aug 2003, Bocayuva *et al.* 46 (RUSU).

### 8. *Rhipsalis grandiflora* Haw., Suppl. pl. succ. 83. 1819. (Fig. 5 D–E).

**Epiphyte**, branches ca. 2.5 m long, acrotonically branched, glochids absent. **Stem** segments all of determinate growth, leafless, fleshy or woody, grayish green, cylindrical,  $6.5\text{--}13 \times 0.5\text{--}0.8$  cm, 1–3 (–4) in each branching axis. Areoles borne around the stem segments, glabrous. Young stem segments areoles purplish with 0–1 deltoid minute bract-scale. When on reproductive phase stem segments areoles with 1–2 falcate bract-scales. **Flower** diurnal, 0–2 per areole, sessile, rotate,  $1.5 \times 2.5\text{--}3.0$  cm, lateral, perpendicular to the stem segments, flower-tube absent; pericarpel ca.  $0.2 \times 0.4$  cm, glabrous, slightly immersed in the areole; perigonium segments spreading or reflexed; external segments 5–6, deltoid,  $0.1\text{--}0.6 \times 0.1\text{--}0.2$  cm, semifleshy, greenish, apex acute; internal segments 8–9, oblong,  $0.7\text{--}1.2 \times 0.4\text{--}0.6$  cm, membranaceous, pinkish or yellowish white, apex rounded slightly involute; ovary inferior, stigma with 5 lobes; nectary a ring around the style base. **Fruit** globose, white, glabrous, indehiscent, with persistent black perigonium.

This species is heliophyte or semiheliophyte. The stem segments frequently have lacerated regions. The flowers have a sweet smell and are visited by bees which are supposed to be the pollinators. Flowers in October and fruits in November. Few fruits were observed on specimens from NMPP. *Rhipsalis grandiflora* when sterile is similar to *R. teres* f. *heteroclada* (Britton & Rose) Barthlott & N.P. Taylor but can be distinguished because it has all the stem segments of determinate growth and lacks composite terminal areoles. The purplish areoles in its young stem segments is a feature also present in other species such as *R. neves-armondii* K. Schum. which can be distinguished by its pinkish flowers with golden yellow stamens and conspicuously erumpent flower buds borne in wooly areoles. In general *R. grandiflora* is stouter than all the similar species and its flowers are conspicuously large and showy. It is endemic of the Brazilian Atlantic Forest and its habitat is reducing due to the urbanization. **Conservation status:** Near threatened (NT).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Bosque das Mirtáceas, 12 Apr 2003, Calvente *et al.* 32 (RUSU); Trilha para o Cruzeiro do Sul, 11 Jun 2004, Calvente & Versieux 95 (RUSU); ibidem, 10 Oct 2004, (17 Oct 2004, fl. cult.), Calvente & Versieux 117 (RUSU).

### 9. *Rhipsalis paradoxa* (Salm-Dyck ex Pfeiff.) Salm-Dyck subsp. **paradoxa** in Cact. Hort. Dyck. 1849:228. 1850. (Fig. 5 F).

*Lepismium paradoxum* Salm-Dyck ex Pfeiff. in Enum. Diagn. Cact. 140. 1837.

**Epiphyte**, branches ca. 2 m long, acrotonically branched, glochids absent. **Stem** segments all of indeterminate growth, leafless, fleshy, green,  $9\text{--}21(26) \times 1\text{--}2$  cm, 1–3 in each branching axis, 3-winged in transversal section; wings  $3.0\text{--}7.5 \times 0.4\text{--}0.6(1.0)$  cm, discontinuous in the same segment, subsequent to the areoles. Areoles borne around the stem segments, glabrous. **Flower** diurnal, sessile, rotate,  $1.5 \times 2.0$  cm, white, lateral, flower-tube absent; pericarpel ca.  $0.4 \times 0.4$  cm, glabrous; perigonium segments ca. 8, oblong,  $0.7\text{--}1.2 \times 0.15\text{--}0.3$  cm, apex rounded; ovary inferior, stigma with 5 lobes. **Fruit** depressed-turbinate,  $0.4\text{--}0.8$  cm diam., white, glabrous, indehiscent, perigonium deciduous.



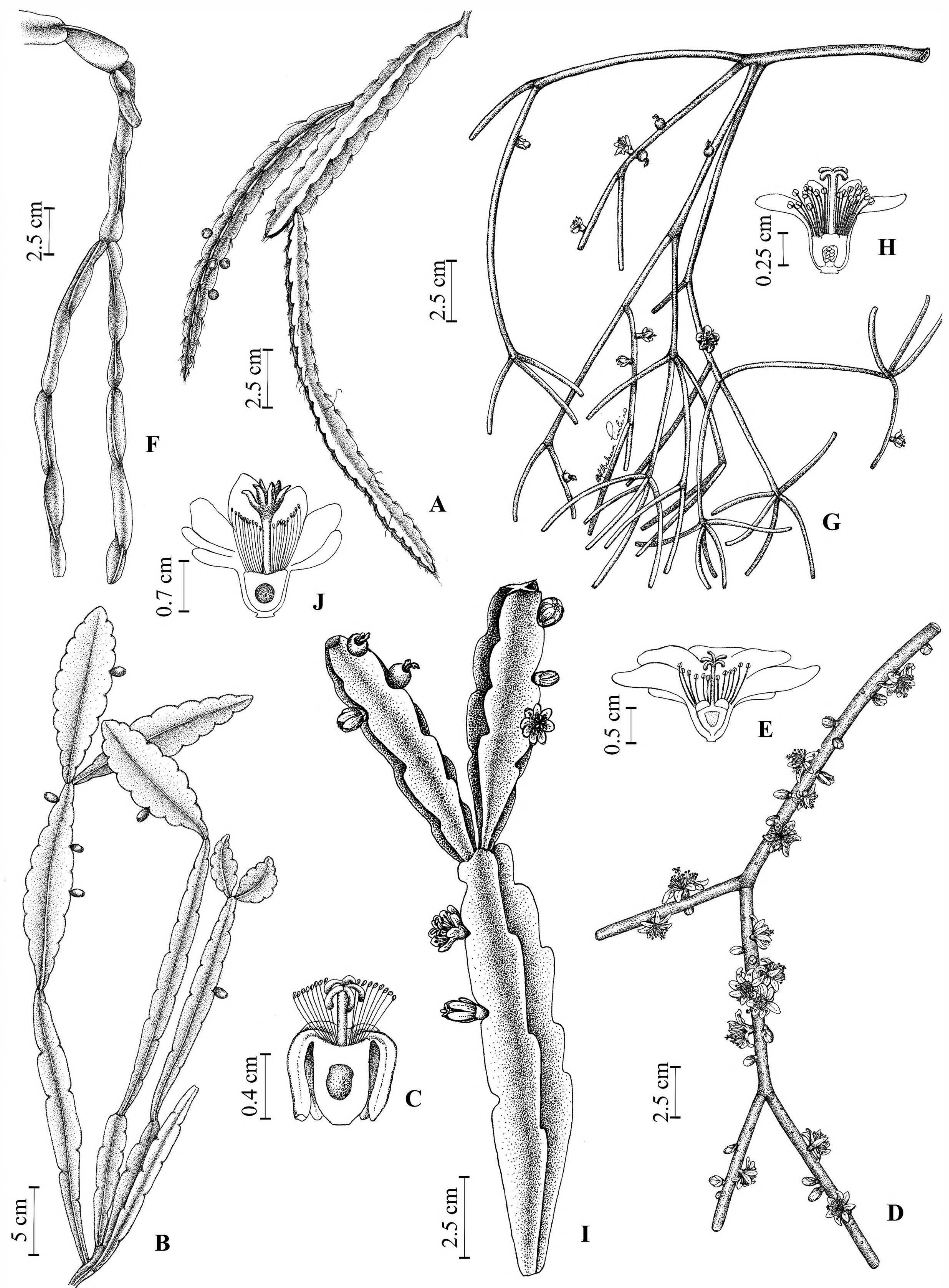


FIG. 5. A. *Lepismium cruciforme* (Vell.) Miq., branch with fruits. B–C. *Rhipsalis elliptica* G. Lindb. ex K. Schum.; B. Branch with fruits, C. Longitudinal section of flower. D–E. *Rhipsalis grandiflora* Haw.; D. Branch with flowers, E. Longitudinal section of flower. F. *Rhipsalis paradoxa* (Salm-Dyck ex Pfeiff.) Salm-Dyck subsp. *paradoxa*, branch. G–H. *Rhipsalis teres* f. *heteroclada* (Britton & Rose) Barthlott & N.P. Taylor; G. Branch with flowers and fruits, H. Longitudinal section of flower. I–J. *Rhipsalis triangularis* Werderm.; I. Branch with flowers and fruits; J. Longitudinal section of flower.



This is a sciophyte species that in the NMPP was not found fertile so the flowers and fruits are described here according with additional specimens. It is endemic of the Brazilian Atlantic Forest and its habitat is reduced due to the deforestation and urbanization. *Rhipsalis paradoxa* subsp. *septentrionalis* N.P. Taylor & Barthlott occurs in Pernambuco, Bahia, Minas Gerais and Espírito Santo states and is distinguished from the typical subspecies due to its darker yellow flowers and slender stem segments with 0.7–1.1 cm (Barthlott & Taylor 1995). **Conservation status:** Near Threatened (NT).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, *Cardoso* (s.n., RUSU 14317); Bosque das Brasiliopuntias, 10 Oct 2004, *Calvente & Versieux* 116 (RUSU); Mun. Mangaratiba: Reserva Rio das Pedras, Rio Grande, 21–22 Dec 1996, *Lira Neto et al.* 522 (RUSU); trilha para o cambucá, 200–300ms.m, 20 Oct 1996, *Bovini et al.* 1090 (RUSU).

**10. *Rhipsalis teres* f. *heteroclada*** (Britton & Rose) Barthlott & N.P. Taylor, *Bradleya* 13:65. 1995. (**Fig. 5 G–H**). *Rhipsalis heteroclada* Britton & Rose, *Cact.* 4:224. 1923.

**Epiphyte**, branches 1–1.5 m long, acrotonically or subacrotonically branched, glochids absent. **Stem** segments cylindrical, leafless; primary segments long, of indeterminate growth, 8.0–22 × 0.3 cm, 1–2 subsequent, usually woody, grayish; secondary segments short, of determinate growth, 2.0–7.0 × 0.1–0.3 cm, 2–7 in each branching axis, fleshy, green. Areoles borne around the stem segments, usually glabrous, areoles terminal in the stem segments composite and with pilose hairs. Young stem segments areoles with scarce pilose hairs and 1 deltoid minute bract-scale. When on reproductive phase stem segments areoles with 1–2 falcate bract-scales ca. 0.1 cm long. **Flower** diurnal, 0–2 per areole, sessile, rotate, 0.6–0.8 × 0.9–1.0 cm, lateral, sub-apical or apical, slightly oblique to perpendicular to the stem segments, flower-tube absent; pericarpel ca. 0.3 cm diam, glabrous; perigonium segments suberect to spreading, membranaceous, greenish to reddish; external segments 4, deltoid, ca. 0.1 cm long or shorter, the apex slightly reflexed; internal segments 5, triangular to oblong, 0.4–0.6 × 0.1–0.2 cm, apex rounded, sometimes with the margins involute; ovary inferior, stigma with 4 lobes; nectary a ring around the style base. **Fruit** depressed-globose, ca. 0.4 cm diam, greenish white, glabrous, indehiscent, with persistent black perigonium.

This species is frequent at the NMPP as sciophyte to semisciophyte. It is distinct from the other forms of *Rhipsalis teres* (Vell.) Steud. due to the stouter stem segments and larger flowers. The young apical shoots are slender then the mature basal segments. The *Rhipsalis teres* f. *heteroclada* is very hard to be differentiated from the *R. teres* f. *teres* in herbaria, especially in those cases when only the slender apical shoots are collected. For that reason, more detailed studies must be done to establish a more precise morphological differentiation among them. *Rhipsalis teres* f. *heteroclada* is endemic and frequent in the Brazilian Atlantic Forest. It flowers from June to October and fruits from July to November. The fruit mature rapidly. **Conservation status:** Least Concern (LC).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, trilha para a pedra dos Cabritos (morro da Boa Vista), ca. 150 ms.m. 09 Oct 1996, *Braga & Lira Neto* 3557 (RUSU, RB); ibidem, 29 Oct 2003, *Braga et al.* 7232 (RB); ibidem, 15 May 2004, *Calvente & Versieux* 86, 91 (RUSU); Bosque das Mirtáceas, 23° 02' 41,2"S 43° 30' 40,5"W, 09 Jul 2003, *Calvente et al.* 49 (RUSU); trilha para o Cruzeiro do Sul, 03 Oct 2003, *Bocayuva 70 et al.* (RUSU); ibidem, 17 Oct 2003, *Calvente et al.* 61 (RUSU); Bosque das Brasiliopuntias, 11 Jun 2004 (10 Oct 2004, fl. cult.), *Calvente & Versieux* 94 (RUSU).

**11. *Rhipsalis triangularis*** Werderm., Feddes Repert. Spec. Nov. Regni Veg. 1071–1080: 3. 1937. (**Fig. 5 I–J**).

**Shrub** non columnar, rupicolous or epiphyte, acrotonically branched, glochids absent. **Stem** segments all of determinate growth, leafless, fleshy, 6–24 × 1–4(–6) cm, 1–5 in each branching axis, pale green or yellowish green, margin serrate or crenate usually reddish, 3–4(–5) winged, wings continuous at the same segment. Areoles 1,5–2,5 cm apart at the wings margins indents, with short tomentose hairs; bract-scales 0–5, stiff, vestigial from the reproductive phase, similar to spines. When on reproductive phase or young stem segments areoles with 0–8 linear bract-scales. **Flower** diurnal, 0–3 per areole, sessile, rotate, ca. 1.5 × 2.5 cm, lateral, sub-apical or apical, flower-tube absent; pericarpel 0.4–0.6 × 0.4–0.6 cm, glabrous; perigonium segments reflexed or spreading, white; external segments 3–4, deltoid, 0.2–0.4 × 0.4–0.6 cm, slightly fleshy, apex rounded; internal segments 9–10, oblong, 0.5–0.9 × 0.2–0.4 cm, membranaceous,



apex rounded slightly involute; ovary inferior, stigma with 5–7 lobes; nectary a ring around the style base. **Fruit** depressed-globose, 0.6–0.7 × 0.7–0.8 cm, pinkish when immature and white when ripe, glabrous, indehiscent, with persistent grayish black perigonium.

This is a heliophyte or semiheliophyte species which forms large populations at the rock outcrops and probably reproduces vegetatively. The basal stem segments sometimes have the margins lacerated. The flowers are visited by bees which are supposed to be the pollinators, ants and moths. The flowering is abundant and synchronic among the individuals during April to June and scarce in October. Fruits were observed in November and April. Werdermann (1937) described *Rhipsalis triangularis* from a cultivated material which was sent from the Rio de Janeiro Botanical Garden to the Dahlem Botanical Garden and the original habitat of this species was unknown for the author. *Rhipsalis triangularis* during many years was considered a problematic taxa because of the absence of the type material and new collections with the features described by Werdermann (Barthlott & Taylor 1995). However the specimens found at the NMPP fit perfectly in the original description of *R. triangularis* with the exception of few differences which can be attributed to different environmental conditions or to the fact that Werdermann (1937) based his description in one specimen with only 3 stem segments. These few differences are that the specimen described by Werdermann had faintly indented serrate margins, absence of aerial roots and pale green pericarpel while the NMPP populations have in general crenate or serrate margins, presence of aerial roots and brownish green or pinkish magenta pericarpel. *Rhipsalis agudoensis* N.P. Taylor is similar to *R. triangularis* but is distinct for its magenta pink fruits and is referred to a distant site, the city of Agudo at the Rio Grande do Sul State (Taylor 2003). Further field studies are necessary to better evaluate the relation between *Rhipsalis agudoensis* and *R. triangularis*. **Conservation status:** Critically Endangered (CR).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Pedra dos Cabritos, 340 ms.m., (mirante Boa Vista), 06 Jun 1996, Braga & Bovini 3357 (RUSU); ibidem, 17 Apr 2003, Calvente & Bocayuva 37, 38 (RUSU); ibidem, 12 Dec 2003, Cardoso & Zaldini 51 (RB); ibidem, 15 May 2004, Calvente & Versieux 87, 89, 90 (RUSU); Cruzeiro do Sul, 06 Jun 2003, Calvente et al. 42 (RUSU); Bosque das Brasiliopuntias, 10 Oct 2004, Calvente & Versieux 107a, 112 (RUSU).

## 12. *Cereus fernambucensis* Lem. subsp. *fernambucensis*, Cact. gen. sp. nov. 58. 1839. (Fig. 4 C–D).

*Cereus obtusus* Haw., Rev. pl. succ. 70. 1821.

Shrub, columnar, prostrated or erect, terricolous or rupicolous, glochids absent. Stem segments leafless, fleshy, 12–26 × 3–5 cm, 2–3(–4) in each branching axis, grayish green; ribs 4–5, 1–2 cm wide, ca. 1 cm thick, margin entire, faintly crenate or incised. Areoles borne at the ribs margins indents, with short tomentose hairs; central spines 1–3, acicular, 1.0–3.2 cm long, stiff; lateral spines 2–5, acicular, 0.4–1.5 cm long, stiff. Flower nocturnal, 0–1 per areole, sessile, infundibuliform, 17–23 × 13–17 cm, lateral; pericarpel ca. 1.5 × 1.2 cm; flower-tube 9–12 × 1 cm; pericarpel with bract-scales deltoid, ca. 0.2 cm long, apiculate, green, towards the flower-tube apex gradually becoming purple, oblong, ca. 1.5 cm long with apiculus absent; perigonium external segments ca. 14 oblong, 2.0–5.5 × 0.7–0.9 cm, slightly fleshy, purplish green, spreading, apex acute; internal segments ca. 30, obelliptic or oblong, 3.8–5.0 × 1.0–2.0 cm, membranaceous, pinkish white, suberect, base attenuate, apex rounded; ovary inferior, stigma with 13 lobes; nectar-chamber ca. 7 cm long. Fruit depressed-oblong, ca. 6 × 5 cm, magenta, glabrous, dehiscent by a longitudinal slit, perigonium deciduous.

In the NMPP this species is frequent as heliophyte in the open restinga vegetation and on the rock outcrops close to the beach and its altitudinal distribution reaches 100 ms.m at the most. Small coleopterans feed on the androecious after the anthesis. It flowers annually from September to October and fruits from October to March. Few fruits are produced after flowering and those were found ripe on the following year flowering season. It is endemic of the Brazilian Atlantic Forest. In the Rio de Janeiro State occur *Cereus fernambucensis* subsp. *sericifer* (F.Ritter) N.P. Taylor & Zappi and the typical subspecies, which is distinguished by its coastal distribution and magenta pink fruits, while *C. fernambucensis* subsp. *sericifer* has an inland distribution and yellows fruits (Taylor & Zappi 2004). **Conservation status:** Least Concern (LC).



Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, sob pedra na praia, 10 Sep 2003, Calvente & de Paula 51 (RUSU); ibidem, 1 Oct 2004, Calvente & Versieux 102, 103, 104 (RUSU).

**13. Coleocephalocereus fluminensis** (Miq.) Backeb. subsp. **fluminensis**, Jahrb. Deutsch. Kakteen-Ges. 1941(2):53. 1942. (**Fig. 4 E–F**). *Cereus fluminensis* Miq., Bull. Sci. Phys. Nat. Néerl. 48. 1838.

Shrub, columnar, 50–130 cm, erect or semidecumbent, rupicolous, glochids absent. Stem segments leafless, fleshy, sometimes woody at base, 60–180(–240) × 10 cm, green; ribs 9–15, ca. 1.5 cm wide, 1–2 cm thick, margin entire. Areoles borne at the ribs margins, with short tomentose hairs; spines 3–7, acicular, 1.5–3.0 cm long, flexible, gray, yellowish at the apex, usually 1 central and the others lateral. Cephalium lateral, 10–15(–30) × 5–7 cm, with copious long, lanate hairs; spines acicular, 3–5 cm long, sometimes undulate or curve, flexible, golden yellow with brownish apex. Flower nocturnal, borne on the cephalium, 1–2 in each flowering, sessile, infundibuliform, ca. 7 × 5 cm, pink; pericarpel ca. 0.8 × 0.8 cm, glabrous; flower-tube with minute bract-scales sometimes involute; perigonium segments ca 65, triangular to oblong, 1.0–2.0 × 0.3–0.6 cm, membranaceous, spreading, apex acute sometimes involute; ovary inferior, stigma with 13 lobes; nectar-chamber 1.2 cm long. Fruit obconic, ca. 2.6 × 2.1 cm, magenta, glabrous, dehiscent by a basal pore, with persistent black perigonium.

In the NMPP this taxon is frequent on the rock outcrops as heliophyte commonly growing on mosses. The flowers are supposed to be bat pollinated because of its morphology and the fruits are frequently visited by lizards and ants which are supposed to be the dispersers. It flowers synchronically in January, April, June, August and October. The fruits were observed from March to November and are ripe almost during the whole year, being released gradually by the cephalium. The specimens are threatened by the fire on the rock outcrops and inhabit areas with hiking and climbing tracks where they are regularly destroyed. This is a Brazilian Atlantic Forest endemic taxa vulnerable at the Rio de Janeiro State. It is distinguished of *Coleocephalocereus fluminensis* subsp. *decumbens* (F.Ritter) N.P. Taylor & Zappi, which is a Minas Gerais State endemic species, mainly due to its green grayish stem segments and dark brown spines (Taylor & Zappi 2004). **Conservation status:** Vulnerable (VU).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Pedra dos Cabritos (morro da Boa Vista), 359 ms.m., 06 Jun 1996, Braga & bovini 3342 (RUSU, RB); ibidem, 17 Apr 2003, Calvente & Bocayuva 36 (RUSU); ibidem, 29 Jan 2004, Calvente & Versieux 81 (RUSU); Cruzeiro do Sul, 28 Oct 2003, Calvente & Bocayuva 67 (RUSU).

**14. Pilosocereus arrabidaei** (Lem.) Byles & Rowley, Cact. Succ. J. Gr. Brit. 19:66. 1957. (**Figs. 4 G–H**). *Pilosocereus arrabidaei* Lem., Rev. Hort. 34:429. 1862.

**Shrub**, columnar, 1–2 m, erect, rupicolous, glochids absent. **Stem** segments 30–150 × 5–7 cm, leafless, fleshy, rarely woody at base, green; ribs 5–6, 1.4–2.0 cm wide, ca. 2.5 cm thick, margin entire. Areoles borne at the ribs margins, with short tomentose hairs; lateral spines 5–10, acicular, 0.2–1.0 cm long; central spines 1–3, acicular, 1.0–2.0(–3.0) cm long; areoles at the stem segment apex with scarce, long, pilose hairs. **Flowers** nocturnal, 0–1 per areole, sessile, infundibuliform, 6–7(–9) × 3–4 cm, lateral; pericarpel ca. 0.9 × 1.9 cm, with 2–3 sparse bract-scales; flower-tube with 0–2 sparse fleshy deltoid bract-scales; perigonium segments deltoid, apex acuminate; external segments (0.5–)1.0–1.4 × 0.7–1.0 cm, fleshy, greenish, suberect; internal segments 1.4–2.2 × 0.5–1.0 cm, membranaceous, white, spreading; ovary inferior, stigma with 9 lobes; nectar-chamber ca. 0.9 cm long. **Fruit** depressed-globose, 2–4 × 3–4.5 cm, magenta red, glabrous, dehiscent by a lateral slit, with persistent black perigonium.

It is a heliophyte species rare at NMPP but common at the adjacent *restinga* of Grumari. It is probably pollinated and dispersed by bats due to its flowers and fruits morphology. It flowers and fruits in October. *Pilosocereus arrabidaei* is a Brazilian Atlantic Forest endemic usually inhabiting the coastal *restingas*. The Rio de Janeiro State is the southern limit of its geographic distribution where its natural habitat is threatened by human interference. **Conservation status:** Near Threatened (NT).

Specimens examined: **BRAZIL. Rio de Janeiro:** Mun. Rio de Janeiro, Parque Natural Municipal da Prainha, Cruzeiro do Sul, 28 Oct 2003, Calvente & Bocayuva 70 (RUSU).



## FLORISTIC ASPECTS

The Cactoideae subfamily was the most diverse at the NMPP, with 79% of the inventoried species and is followed by Opuntioideae (14%) and Pereskioideae (7%). Four tribes of Opuntioideae and Cactoideae occur at the area of study: Opuntieae, Hylocereeae and Rhipsalideae with 2 genera each and Cereeae, the largest one with 3 genera. The Pereskioideae is monogeneric and only one species belonging to this subfamily occur at the NMPP, *Pereskia aculeata*. The richest genus is *Rhipsalis*, with five species, while the other genera present only one species each (Fig. 6, Table 1).

In the NMPP, 50% of the taxa are strictly terrestrial and among them 43% are only rupicolous, 43% are rupicolous or terricolous and 14% are only terricolous. The exclusive epiphytes correspond to 36% of the inventoried species and they belong mostly to Rhipsalideae. The 14% remaining species can be either epiphytic or terrestrial (Figs. 7, 8).

Three main vegetation physiognomies can be recognized in the NMPP, the coastal ombrophilous forest (Atlantic Rain Forest), the *restinga* vegetation (beach or scrub and herbaceous vegetation at plain sands dunes) and the rock outcrops. Most of the taxa (36%) occur only in forested areas as epiphytes, however, 29% of the species can be found either in forested areas or on rock outcrops and 21% inhabit exclusively the rock outcrops. *Opuntia monacantha* is restricted to the *restinga* and *Cereus fernambucensis* subsp. *fernambucensis* can occur either in the *restinga* or on rock outcrops, both cases correspond to 7% of the studied species (Fig. 9).

It can be observed that the species present habit plasticity, what is especially true concerning the taxa present at the rock outcrops. Taxa as *Pilosocereus arrabidae* that are usually found as terricolous in *restinga* vegetation or others as *Rhipsalis elliptica* that are preferably epiphytes at forested areas are found as rupicolous at the rock outcrops, this also indicates that some particular conditions, such as high solar irradiation, water stress and temperature could be common both to those terrestrial, rupicolous and epiphytic habitats, however, more accurate studies are necessary.

The comparative analyses of the Cactaceae floristic results of this work with other areas at the Rio de Janeiro State demonstrate greater similarity of the NMPP with other coastal areas represented by APA of Cairuçu, APA of Maricá, National Park of the Restinga of Jurubatiba and APA of Massambaba (Table 2, Fig. 10). These areas have taxa that are characteristic of *restinga* pioneer formations as *Pereskia aculeata*, *Brasilopuntia brasiliensis*, *Opuntia monacantha*, *Hylocereus setaceus* e *Cereus fernambucensis* subsp. *fernambucensis*. In spite its location inside the Rio de Janeiro City, the area of the Vista Chinesa Forest Reserve is less similar with the costal areas (Table 2, Fig. 10). This area comprises only Atlantic Forest formations lacking the *restinga* vegetation characteristic taxa. The same applies to the Macaé de Cima Reserve, located in the mountains of the Órgãos range in the Rio de Janeiro State, which can be even more differentiated in floristic aspects due to altitudinal and climate peculiarities (e.g. Lima & Guedes-Bruni 1997; Rocha et al. 2003; Calvente et al. 2005).

## CONSERVATION

The taxa occurring in the NMPP are grouped under four threat categories: Critically Endangered (CR), Vulnerable (VU), Near Threatened (NT) and Least Concern (LC).

*Rhipsalis triangularis* is considered Critically Endangered because of its restricted populations only currently known to occur in small areas at the NMPP and because of the fragility of its habitat. *Coleocephalocereus fluminensis* subsp. *fluminensis* inhabits exclusively rock outcrops at the Rio de Janeiro State and is the only taxa evaluated as Vulnerable (VU) in the NMPP, corresponding to 7% of the total number of taxa (Fig. 11). This species suffer with the urbanization, pollution and human interference manifested through vandalism, fire and lack of planning for the use of rock outcrops areas. This results in the decline of their population and in the decrease of habitat quality and for that reason the conservation of populations of this species in the NMPP must be strongly assured.

*Rhipsalis grandiflora*, *R. paradoxa* subsp. *paradoxa*, and *Pilosocereus arrabidae* are considered Near Threatened (NT) corresponding to 21% of studied taxa (Fig. 11). Their habitat is decreasing because of the great



TABLE 1. Cactaceae taxa occurring at the Natural Municipal Park of Prainha, RJ.

Subfamily	Tribe	Genus	Specific & infraspecific taxa	Conservation status
Pereskioideae	—	<i>Pereskia</i>	<i>P. aculeata</i>	LC
Opuntioideae	Opuntiaea	<i>Brasiliopuntia</i>	<i>B. brasiliensis</i>	LC
	<i>Opuntia</i>	<i>O. monacantha</i>	LC	
Cactoideae	Hylocereeae	<i>Epiphyllum</i>	<i>E. phyllanthus</i> subsp. <i>phyllanthus</i>	LC
	<i>Hylocereus</i>	<i>H. setaceus</i>	LC	
Rhipsalideae	<i>Lepismium</i>	<i>L. cruciforme</i>	LC	
	<i>Rhipsalis</i>	<i>R. elliptica</i>	LC	
		<i>R. grandiflora</i>	NT	
		<i>R. paradoxa</i>	NT	
		subsp. <i>paradoxa</i>		
		<i>R. teres</i> f. <i>heteroclada</i>	LC	
Cereeae	<i>Cereus</i>	<i>R. triangularis</i>	CR	
		<i>C. fernambucensis</i>	LC	
		subsp. <i>fernambucensis</i>		
		<i>Coleocephalocereus</i>	<i>C. fluminensis</i>	VU
		subsp. <i>fluminensis</i>		
		<i>Pilosocereus</i>	<i>P. arrabidae</i>	NT
Total	3	4	10	14

TABLE 2. Similarity values between the inventoried areas for the Cactaceae family at the Rio the Janeiro State (Freitas 1990/92, 1996,1997; Rizzini et al. 1990; Scheinvar et al. 1996; Moura & Costa 2001), greater values are shown in bold.

	PNMP	Macaé de	Cairuçu Cima	Maricá	Vista	Jurubatiba Chinesa	Massambaba
PNMP	*	9.5238	<b>59.26</b>	56	42.8571	<b>60.8696</b>	<b>59.2593</b>
Macaé de Cima	*	*	10	0	28.5714	0	0
Cairuçu	*	*	*	<b>66.67</b>	<b>59.2593</b>	<b>63.6364</b>	<b>69.2308</b>
Maricá	*	*	*	*	40	<b>80</b>	<b>75</b>
Vista Chinesa	*	*	*	*	*	43.4783	44.4444
Jurubatiba	*	*	*	*	*	*	<b>72.7273</b>
Massambaba	*	*	*	*	*	*	*

pressure caused by the deforestation and urbanization expansion. If their conservation is not guaranteed they may be more threatened in the future, this is particularly important to *P. arrabidae* because it inhabits the *restinga* vegetation, which is more threatened every day because of the aggressive urbanization and tourism development in the coast of the Rio de Janeiro State (Joly et al. 1999). Conservation units located in those coastal regions like the NMPP and the APA of Grumari must be in greater number, more protected and controlled by the government to assure the preservation of their biological diversity.

Taxa under Low Risk (LC) are *Pereskia aculeata*, *Brasiliopuntia brasiliensis*, *Opuntia monacantha*, *Epiphyllum phyllanthus* subsp. *phyllanthus*, *Hylocereus setaceus*, *Lepismium cruciforme*, *Rhipsalis elliptica* and *R. teres* f. *heteroclada*, corresponding to 65% of sampled taxa. They are usually more frequent or widely distributed in the Rio de Janeiro State and their populations are in a less priority situation in spite the reduction of their habitat (Fig. 11).

Many *Coleocephalocereus fluminensis* subsp. *fluminensis* specimens were seen burned and dead inside



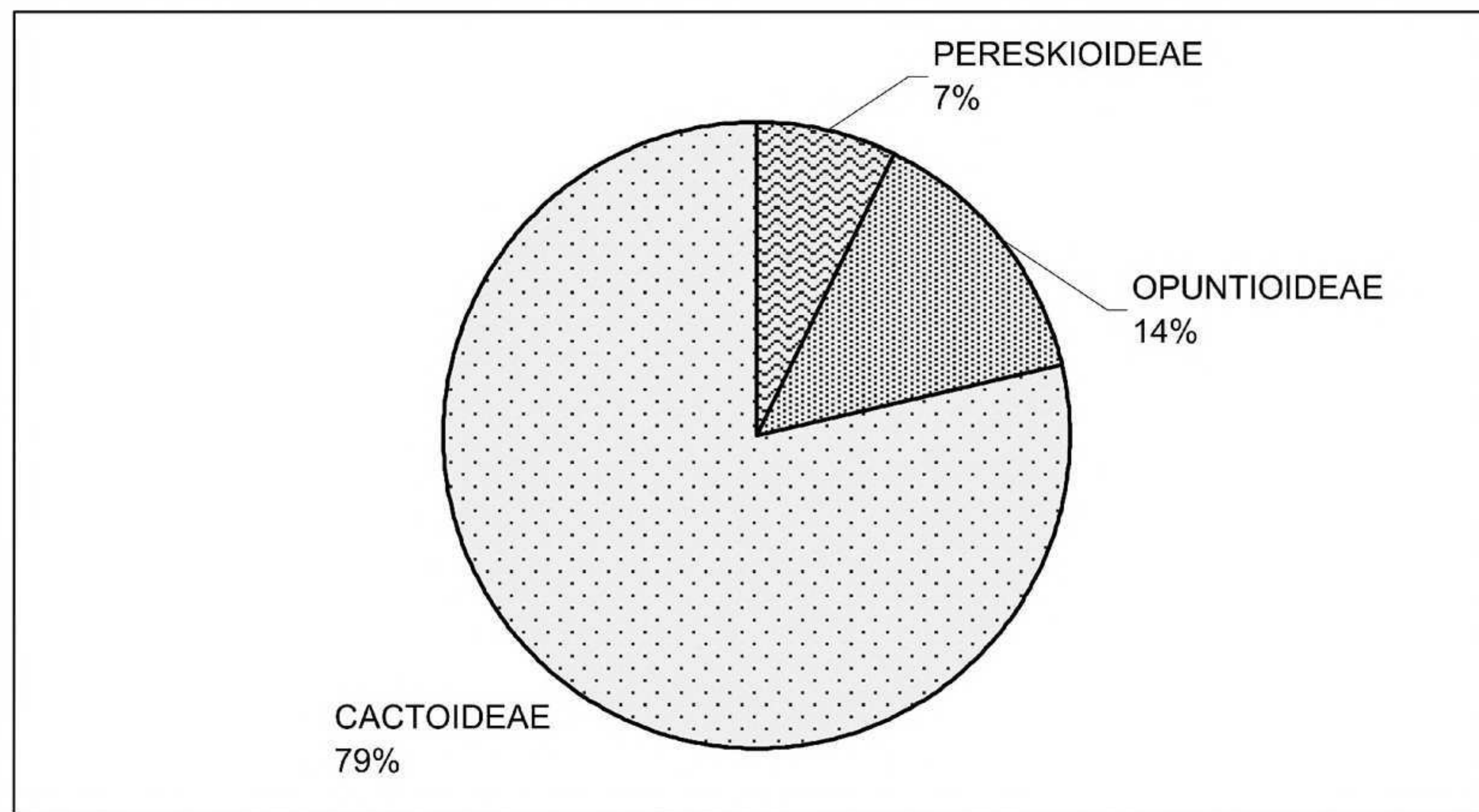


FIG. 6. Percentage of each subfamily of Cactaceae at the Natural Municipal Park of Prainha, RJ.

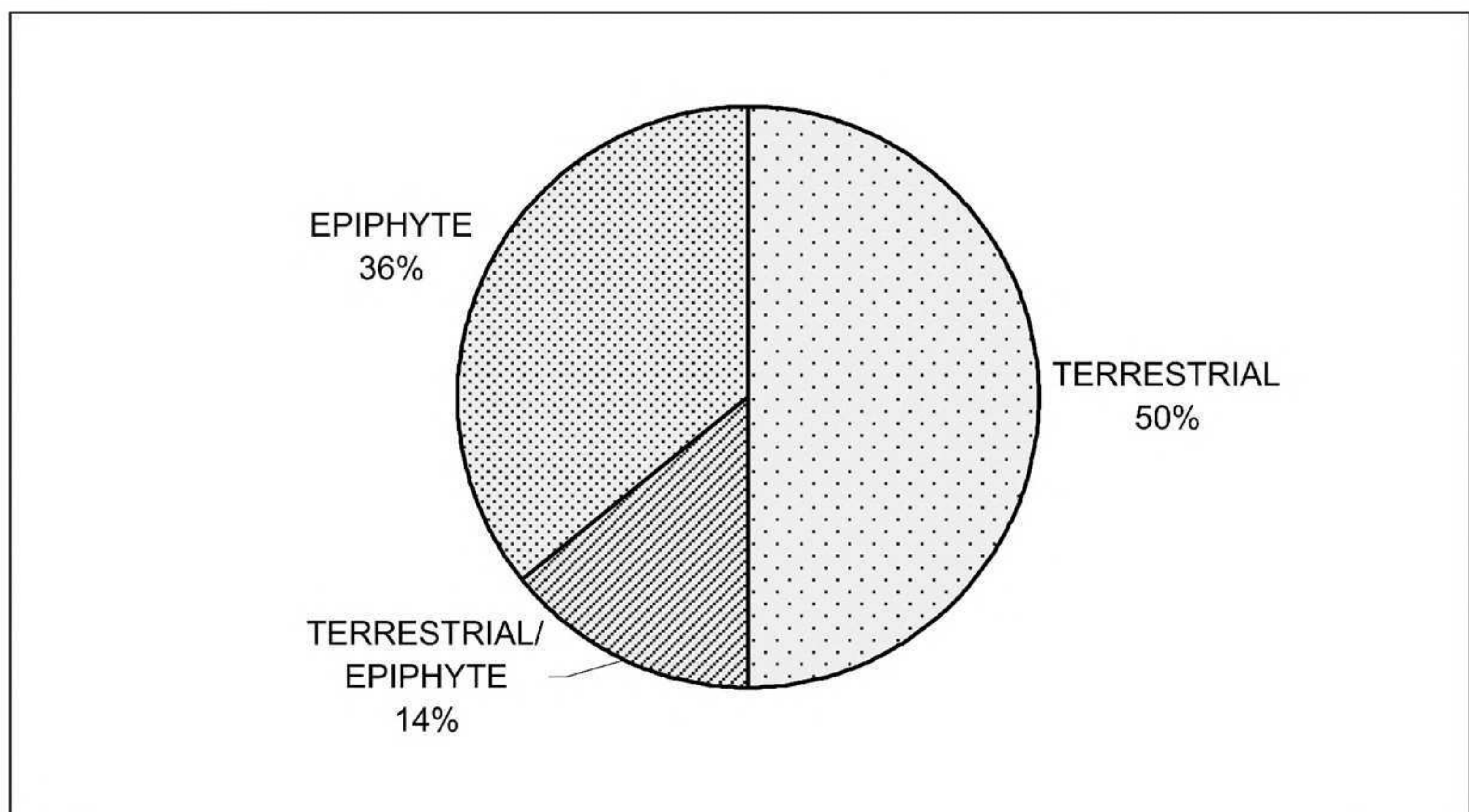


FIG. 7. Percentage of each Cactaceae habit at the Natural Municipal Park of Prainha, RJ.

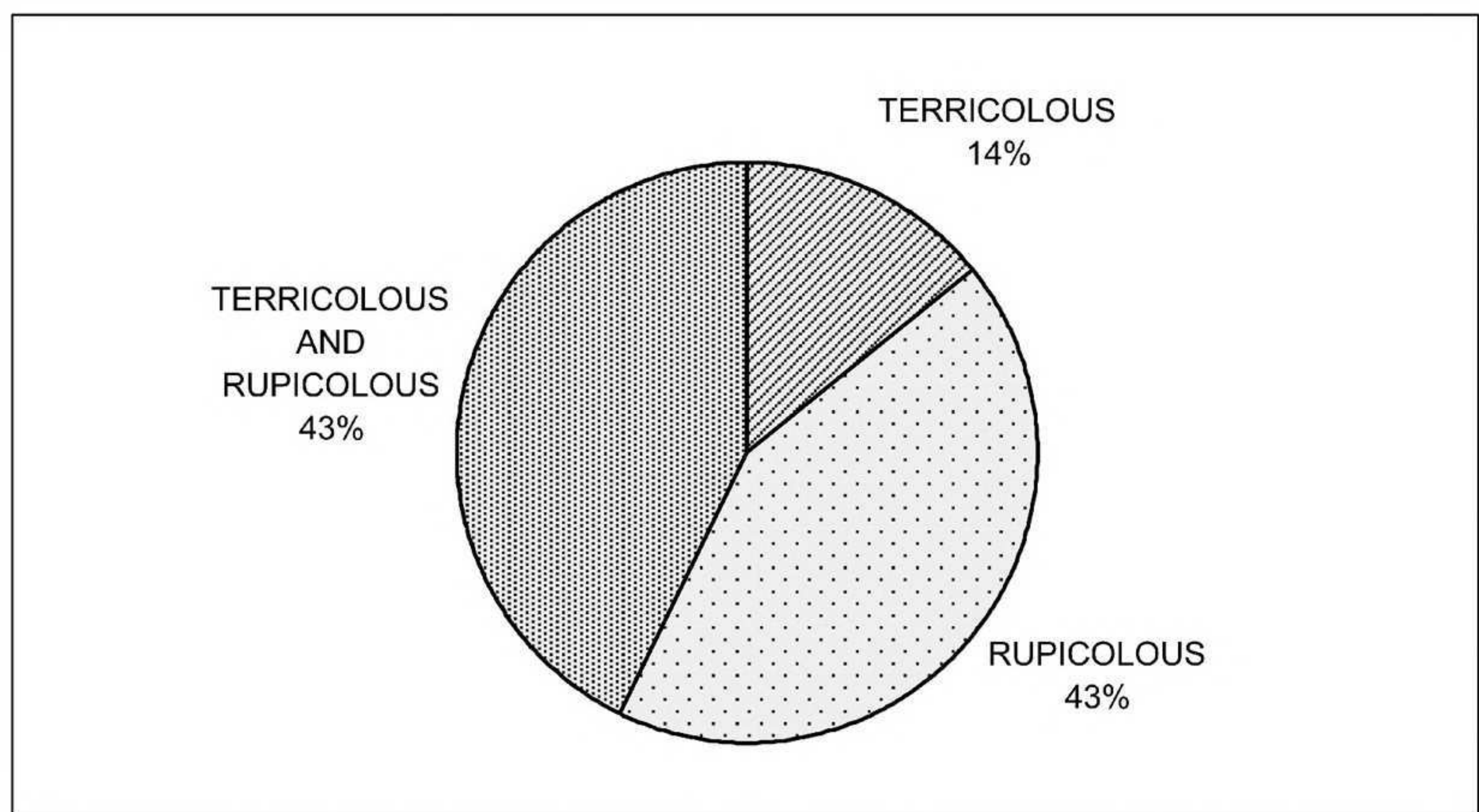


FIG. 8. Percentage of each Cactaceae terrestrial habit at the Natural Municipal Park of Prainha, RJ.

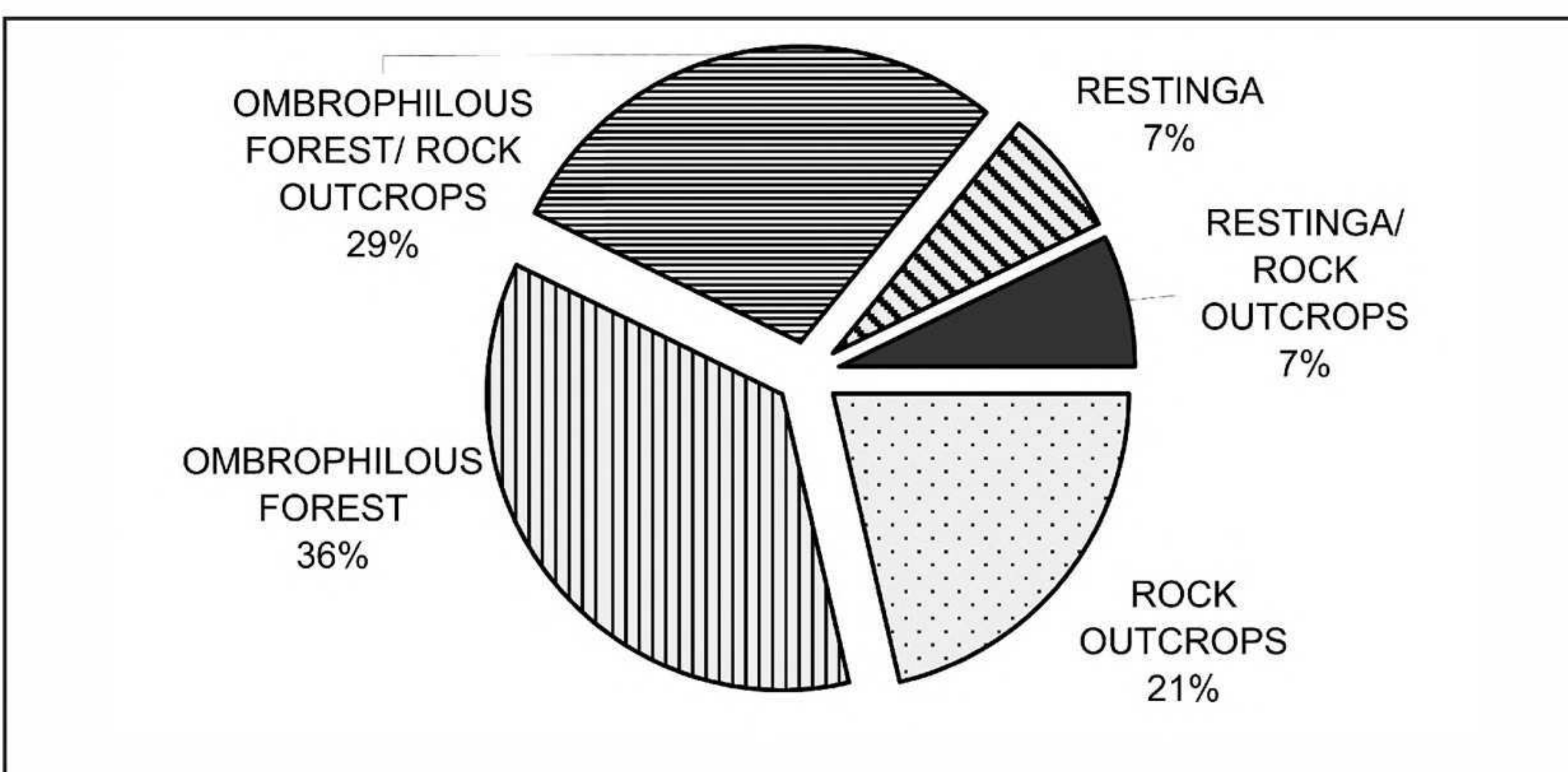


FIG. 9. Percentage of each habitat occupied by the Cactaceae at the Natural Municipal Park of Prainha, RJ.

areas damaged by fire on the rock outcrops in the NMPP. The Cactaceae taxa are highly resistant to water stress and to high solar irradiation, however they do not have any structures that can protect them against fire and once they are burned they hardly regenerate (Gibson & Nobel 1986). The invasion of alien gramineous species of *Panicum* L. and *Melinis* Beauv. can aggravate the situation because they are easily flamed, dispersing the fire to the individuals around them.

The occurrence of climbing paths and tracks on all the extension of the rock outcrops can also represent a threat to the inhabitant taxa of these areas. The Cactaceae individuals are particularly disturbed by this because they are frequently damaged or removed for their prickly stems that are consider a threat by the eyes of visitors. The ideal action was to restrict and signalize specific areas at the rock outcrops to be used for ecological tourism and at the same time develop an education work with the visitors teaching the importance of these species and how to act on the behalf of their conservation.

Porembski et al. (1998) observed the advantages on the colonization of the rock outcrops by the Cactaceae, Bromeliaceae and Velloziaceae. The harsh environmental conditions in these habitats make difficult the establishment of seedlings originated of sexual reproduction, however, the high capacity of clonal growth of these plants raises the chance of a perpetual colonization because the establishment of only one individual result on the formation of great populations in isolated areas.

According with Meirelles et al. (1999) effective actions have to take place in order to protect the rock outcrops. These ecosystems are naturally characterized by high rarity, endemism and fragility values that alone can justify their conservation. Besides that, factors caused by human interference such as pollution, vandalism and fire increase their vulnerability which can result in local extinction.

Banana plant populations were observed in forest areas inside the NMPP and on its surroundings, especially at the APA of Grumari. These populations should be controlled and even removed if necessary because they can disturb the integrity of the original vegetation.

Rocha et al. (2003) listed the main pressures against the conservation of the Pedra Branca State



Jaccard Cluster Analysis (Group Average Link)

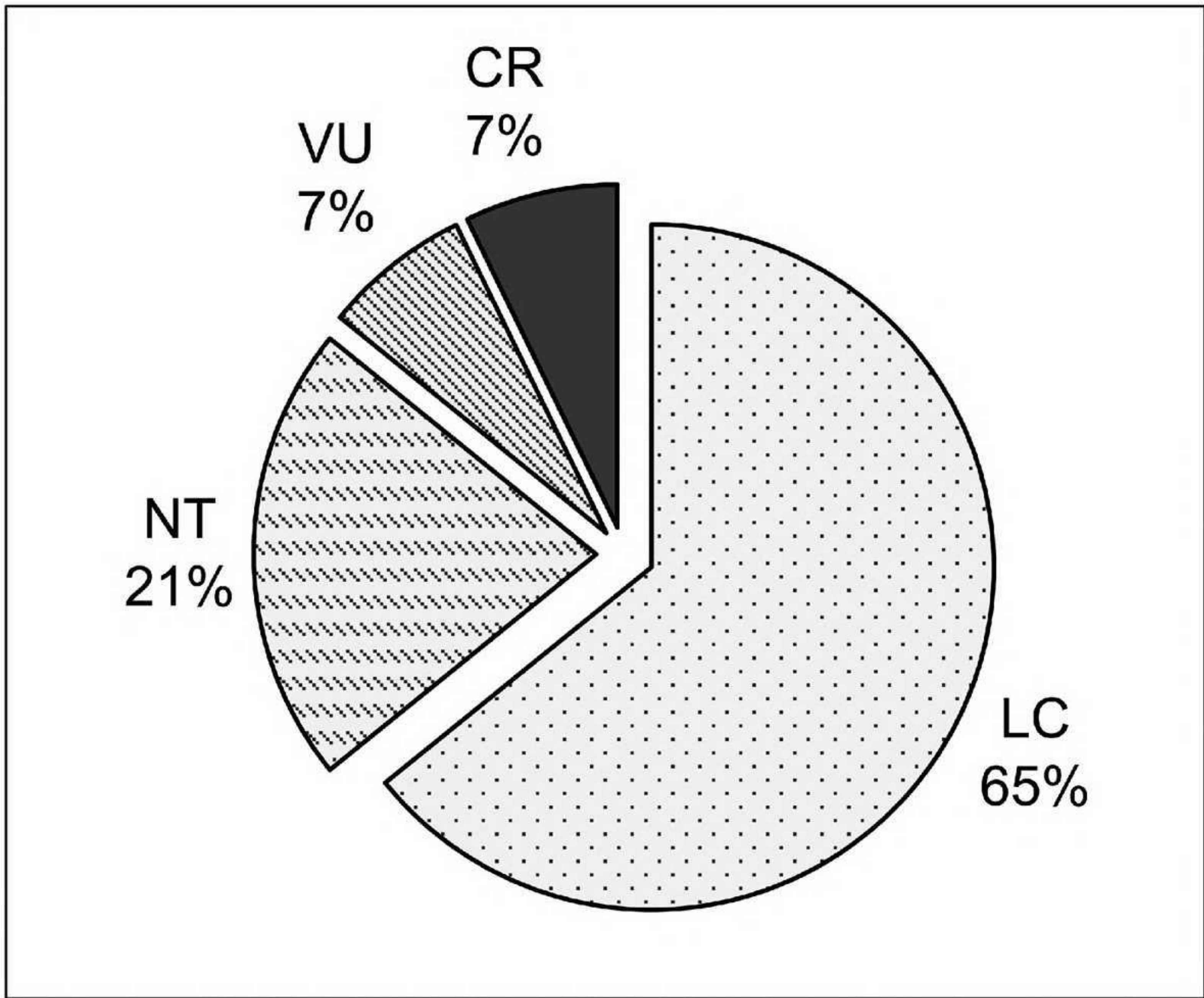
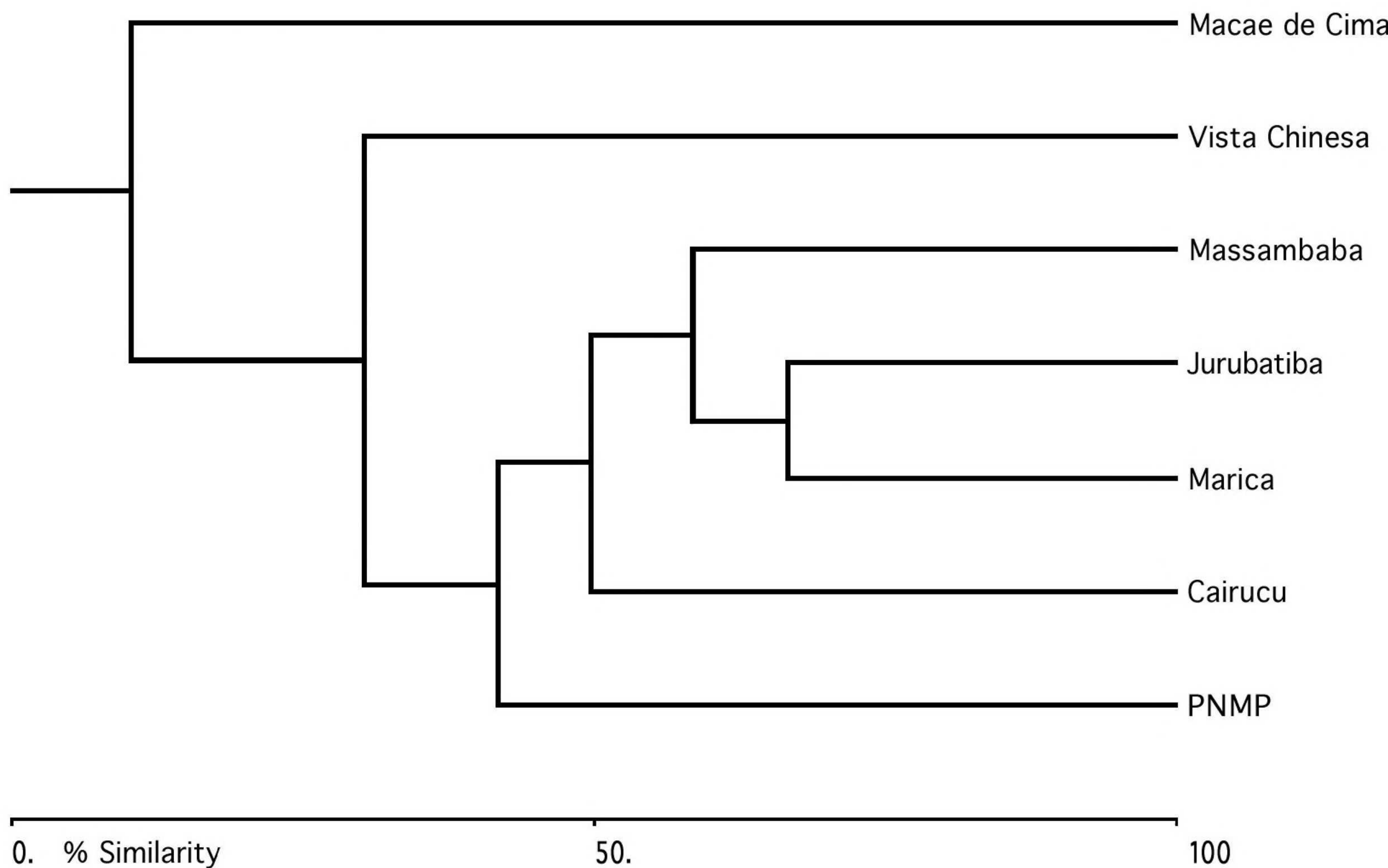


FIG. 10. (Above) Similarity between the inventoried areas for the Cactaceae family at the Rio de Janeiro State (Freitas 1990/92, 1996, 1997; Rizzini et al. 1990; Scheinvar et al. 1996; Moura & Costa 2001)

FIG. 11. Percentage of each conservation statuses evaluated for the Cactaceae taxa at the Natural Municipal Park of Prainha, RJ..

Park and among them is the removal of the original forests for the establishment of monocultures as the banana.

Visitors and people that work at the NMPP reported de occurrence of the extraction of ornamental plants including cacti probably with the objectives of commercialization or cultivation in private properties. Traps and camping signs suggest the action of hunters at the NMPP what compromises not only the animal species but also the plant species because the opening of many new tracks disturbs the regenerating native vegetation. Authority measures must be taken to eliminate these noxious activities at the NMPP.

It is possible to observe that the NMPP is still under many threats regardless of being a Conservation Unit. One important step for the resolution of these problems would be the creation of a management plan capable of assuring that the resolutions listed on the NMPP creation decree are effectively implemented. Among them, the planning of a well directed ecological tourism at the area and the precise delimitation of



the zone for environmental regeneration and of the intangible zone, which is to be designated exclusively for the preservation of the natural resources would be critical.

#### ACKNOWLEDGMENTS

The authors thank the administration of the NMPP and the Secretaria Municipal de Meio Ambiente do Rio de Janeiro for the plant collection permit; the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes) for the graduate student fellowship and to the Conselho Nacional de Pesquisas (CNPq) for the research productivity grant to the first and second authors respectively; to Beat Leuenberger and Ralf Bauer for kindly providing their bibliography; to the curators of the consulted herbaria; to Maria Helena Pinheiro for the ink drawings; to Eduardo Luís Martins Catharino and one anonymous reviewer for valuable comments; and for all people that contributed for this work especially to Melissa Bocayuva, Leonardo Versieux, Leandro Cardoso, Carlos Alberto Zaldini and to João Marcelo Braga.

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